PERFORMANCE TESTS OF INTELLIGENCE

A Series of Non-linguistic Tests for Deaf and Normal Children

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PERFORMANCE TESTS OF INTELLIGENCE

A Series of Non-linguistic Tests for Deaf and Normal Children

BY

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being given to 1000 unselected deaf children in London, Manchester, Leeds, Bradford, Birmingham, and Boston Spa.

For encouragement and help given, and in some cases for assistance in the actual work of testing, the authors desire to place on record their indebtedness to Mr Barker of Henderson Row, Messrs Skinner and Young of Donaldson's Hospital, the various teachers in both institutions, Mr Richardson and Mr Robbie, Headmasters of Education Authority schools, and to Dr R. W. D. Fairbairn of the George Combe Department of Psychology.

J. D.
M. C.

UNIVERSITY
EDINBURGH, *May* 1928

PREFACE TO SECOND EDITION

In the present edition, the following alterations have been made :—

1. New norms, based on the result of the employment of the tests on a larger scale, have been substituted for the provisional norms of the first edition. As these results have indicated significant sex differences, separate norms are given for boys and girls.
2. A slight alteration has been made in the scoring of Test VII, the cube construction test.
3. In response to numerous requests, instructions have been added for giving the tests, with a minimum of language, to hearing children.

Apart from these changes, the directions and scoring remain as before.

The authors desire to express their indebtedness to many headmasters and teachers of deaf and hearing children, and to the College of Teachers of the Deaf, for their never-failing help and encouragement.

J. D.
M. C.

University
Edinburgh, *December* 1935

PREFACE TO THIRD EDITION

A NUMBER of alterations and additions have been made in this edition. The directions for giving the tests with a minimum of language have been moved from the Appendix to the text; a Table for the reading off I.Q.'s from age and score has been added; and provisional norms for an "Abbreviated Scale" using only three tests have been given. The authors have frequently requests for norms for the individual tests. Since the scoring is simplified and the individual tests so scored are meant only as items in a scale, separate norms would not be of much value for practical purposes.

J. D.
M. C.

UNIVERSITY
EDINBURGH, *January* 1944

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PERFORMANCE TESTS OF INTELLIGENCE

CHAPTER I

PERFORMANCE TESTS

A DISTINGUISHED American psychologist—Thorndike of Columbia—has maintained that three distinct types of intelligence must be recognised. These he calls respectively, "mechanical," "social," and "abstract" intelligence. By "mechanical" intelligence he means the ability to learn to understand and manage things and mechanisms. By "social" intelligence he means the ability to act wisely in human relations, and by "abstract" the ability to understand and manage ideas and symbols. That these three types have something fundamental in common is indicated by the fact that we call them all types of intelligence. Social intelligence, one might suggest, is largely dependent on feeling, interest, or what we might call temperament, rather than on intelligence in its intellectual aspect, so that we seem really to be left with the two main types of intelligence, the "mechanical" and the "abstract," or, preferably, the "concrete" and the "verbal."

These two types of intelligence have never been equally esteemed. Abstract intelligence, that is the ability to manage ideas and symbols, has always been regarded as the higher type. This has shown itself in the development of the intelligence test. The intelligence tests upon which we have come to rely are predominantly tests of the ability to manage ideas and symbols. In selecting our tests, the criterion we employ is the extent to which the results of our tests correlate with school results and with the estimate of the teachers, both of which are enormously weighted on the side of this abstract intelligence. Now if by "intelligence" we mean good sense or judgment as manifested in the various situations which life presents, then to test a child's intelligence by testing only his ability to deal with ideas and symbols is neither satisfactory nor adequate—is, in fact, just as unsatisfactory and inadequate as to give him an education confined to the use of ideas and symbols. If we are agreed that the handling of concrete material should form part of the child's education, and a much more important part in the case of the majority of children than it forms at present, so likewise we must also admit that in any adequate testing of a child's intelligence, the ordinary type of intelligence test must be supplemented by the kind of tests we call performance tests. These are tests in which the subject has to deal with concrete material; that is, they are tests of the concrete rather than of the abstract type of intelligence. In the Binet tests, which are the tests most frequently employed for the testing of the child's intelligence, some few of the tests are of this type, but the series as a whole is predominantly of the verbal type, and that is still more so with many of the other tests employed.

On the whole it will be found that there is fair agreement between the results given by the ordinary type of intelligence test and the performance test. Nevertheless discrepancies are by no means infrequent. If a child shows special ability with the ordinary verbal intelligence test, but does relatively poorly in performance tests, that child's school education and his vocation in after-life are to some extent at least indicated. The same is true of the child who does poorly in the ordinary type of intelligence test but shows up well in the performance tests. These are the children whose intelligence is characteristically of the concrete type, and in whose education this fact should be clearly recognised.

R. E. Leaming in the *Psychological Clinic*[1] has made a classification based on the results of testing 600 children with mental, scholastic, and performance tests. He recognises four types :—

> "(1) The superior children who do well in both the performance tests and the intellectual tests.
>
> "(2) The children who do poorly in both the performance tests and the intellectual tests.
>
> "(3) The children who do well in the intellectual tests, but make indifferent or even poor records in the performance tests.
>
> "(4) The children who give excellent, sometimes even remarkable exhibitions in the performance tests, and yet do very badly with the intellectual tests."

The first group may be relied upon to do well in any task and be able to adapt themselves to any environment. The second type are inferior in intelligence—both in the abstract and in the concrete. The third type have a fairly high level of intelligence, but their poor score in the performance tests discloses either deficiency of intelligence "in the sense of the ability to solve what for the individual is a new problem," or in the ability to work expeditiously with concrete material. "The children who conform to type 4 are not intellectual, but are either intelligent or skilful in mechanical operations. They should be made ready quickly, with a minimum of efficiency training, to take their place in the world in order that they may pit their intelligence and skill against the intelligence and skill of competitors in some productive field." With this last statement we are only in partial agreement.

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[1] 1923, pp. 24-25.

Performance tests were first developed in connection with the training of mental defectives. The first attempt is that of Itard who endeavoured to train, by means of coloured shapes and forms, "The Wild Boy of Aveyron." He was followed about 1846 by his pupil Seguin, who devised a number of form-boards specifically for those retarded in mental development. His book, *Traitement moral, hygiène, et éducation des idiots*, is the first standard work on the education of the feeble-minded. This was followed in 1864 by his English book, *Idiocy: Its Diagnosis and Treatment by the Physiological Method*.

To this new method of training defectives two developments may be traced, as Miss Gaw has pointed out.[1] In the first place, similar material has been made use of by Montessori and other educationists in teaching normal children; in the second place, it has led to the use of form-boards as tests of intelligence, although they were not adapted for this use until later.[2]

Performance tests nowadays contain many types of tests, besides those we call form-boards, as will be seen from the scale described in this book. But though the actual tests vary, the principle on which they are built up remains constant. They are essentially concrete problems, which the child can solve without the use of language. The tests described later can also be administered without language, thus making them suitable for use for all those who do not comprehend spoken language, or who are unable to hear the spoken word. Performance tests differ from tests of mechanical ability such as those devised by Stenquist. These latter are not so much tests of general intelligence as tests of dexterity of the fingers, and a certain very special kind of intelligence.

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[1] *Performance Test of Intelligence*, Medical Research Council, No. 31.

[2] Norsworthy appears to have been the first to employ form-boards as tests of intelligence (1906).

The Uses of Performance Tests.—Because of the nature of performance tests, they can be employed, as we have seen, where ordinary intelligence tests are not suitable. Intelligence tests of the Binet type are all dependent on the use and apprehension of language. Language is used in giving the test, and language has to be used in responding to the test. Any illiterate or foreigner will suffer from a severe handicap if examined by such verbal tests, and performance tests, such as the scale hereafter described, must be substituted. Again, any individual with a speech disability will not appear to the best advantage in a series of verbal tests.

A second use for performance tests lies in the examining of those suffering from some physical abnormality such as aphasia or deafness. Verbal tests are quite unsuitable in these two cases, and in fact only very few of the Binet type of tests could be used. Both types would suffer severely if their intelligence were estimated purely from results of tests based primarily on language. In fact when Pintner and

Paterson tested deaf children with the Goddard revision of the Binet scale, they found the deaf to be retarded three to four and a half years compared with the normal children.

Thirdly, performance tests are useful in testing normal children. They are useful in the first place for detecting the so-called verbalists who score much higher than they deserve on a verbal scale. In the second place, they can either be used as a substitute for or as a supplement to the Binet or other verbal test. An intelligence examination, composed of a verbal scale and a non-verbal scale, gives the most comprehensive and valuable survey of any one individual's mental ability.

The question has been raised as to how far a performance test can take the place of a verbal test of intelligence. The general finding is that a performance scale in which language is excluded can never take the place of a scale dependent upon the use of language. Terman, for example, holds this view. He points out that if intelligence is the ability to think in abstract ideas, then it is to be expected that the most successful intelligence tests will be those which involve the use of language or other symbols. If we adopt this conception of intelligence then undoubtedly performance tests can never test the higher levels of intelligence. But as we have already pointed out, this is only one aspect of intelligence. As a matter of fact, no agreement has yet been reached as to what the intelligence that is tested by mental tests really is, and psychologists and educationists have all their own ways of defining it. We may claim, therefore, that performance tests do reveal a type of intelligence which plays an important part in the practical work of the world. Where the scale of performance tests is as comprehensive as the one described in the present book, we may by its means determine with a considerable degree of accuracy an individual's status with respect to this type of intelligence. We think indeed that verbal and performance tests should be regarded not as rivals, but as allies. Moreover, performance tests would appear to have one distinct advantage over mental tests of the Binet type, as regards the measure of native intelligence, in that their results are less affected by schooling than are the results of tests of a more verbal nature. Burt, for example, estimates that the results from the Binet-Simon tests are determined to the extent of about 50 per cent. by school attainments. Strong confirmation of this was obtained by Gordon in his study of physical defectives, gipsy and canal boat children.[1]

The Testing of the Deaf.—We have, for some time, been interested in the application of performance tests to the deaf child. A verbal test as a test of mental ability is, of course, in this instance, entirely out of the question.

It is only within recent years that the deaf have been submitted to psychological testing. One of the earliest studies was that of Greenberger,[2] who showed picture books to the deaf child entering an institution, and watched whether he remained apathetic or showed interest in them, taking a show of interest as indicative of a fair mentality. Macmillan and Bruner[3] used a number of well-known tests, the cancellation test, memory tests, perception of size by sense of touch, sensitivity for lifted weights, and some sensori-motor tests. In the test of the higher abilities the deaf were on the whole inferior to the hearing child. Their conclusion is "that this inferiority of the deaf on the mental side perhaps means no more than that the child is from three to four years less mature than the hearing child of his age, and that his date of maturity will be correspondingly delayed."

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[1] Board of Education Reports, 1923.

[2] Doubtful Cases. *American Annals of the Deaf*, vol. xxxiv., No. 2.

[3] Experimental Studies of Deaf Children. Special Report of the Department of Child Study and Pedagogical Investigation, Chicago Public Schools.

It is not until we come to the investigations of Pintner and Paterson that we find definite results. They realised that the fact that a deaf child does not come up to the standard in language ability of the hearing child does not indicate mental deficiency. Accordingly they devised their well known Performance Scale, and although it has been used mainly in testing hearing children up to the present time, it was primarily designed with the deaf in view. The authors of the scale had three aims in view when constructing the scale.

(1) They tried to place in their scale as many different tests as possible, so that all the factors entering into intelligence might be brought into play.

(2) They tried to arrange their scale in such a way that each test presented a relatively new situation to the child; that is, they excluded any test whose solution might be familiar to the child.

(3) As far as possible, they employed tests so constructed that verbal instructions are only necessary for the hearing child. No instructions are necessary for the deaf child, but in some tests a practice is given before the actual test is used.

The results of this scale as given to hearing children are given in their book, *A Scale of Performance Tests*, but the results of the tests as given to deaf children have so far not been published. Pintner and Paterson, however, note in their book on *Intelligence Testing* that in comparing the deaf child and the hearing child by means of their Performance Scale the deaf fall below the hearing.[1]

The same investigators carried out an extensive comparison of deaf and hearing children as regards learning ability. The tests employed were Whipple's Digit-Symbol and Symbol-Digit Tests, both substitution tests. Over 1000 deaf children were tested, and the results compared with the norms obtained by Pyle for the same tests given to hearing children. The conclusions reached may best be summarised in their own words.[2]

1. The deaf child is about three years behind the hearing child in learning ability, as tested by the rapidity and accuracy of forming associations between numbers and forms.
2. The deaf boy is equal in learning ability to the deaf girl, differing in this respect from the hearing boy who falls below the hearing girl.
3. The deaf boy approximates the hearing boy more closely than the deaf girl approximates the hearing girl in learning ability.
4. The congenitally deaf and the adventitiously deaf are equal in learning ability.

Reamer,[3] using a non-verbal intelligence test, also found the deaf to be inferior to the normal to the extent of two years. Further, if the younger children as being a detached group were omitted, then the retardation was to the extent of two and a half years.

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[1] P. 318. From an unpublished manuscript.

[2] *Psychological Monograph*, vol. xx., No. 4.

[3] *Psychological Monograph*, No. 132.

The general finding of these and other experiments is accordingly that the deaf as a class are inferior to hearing children. From the results obtained from our comparison of hearing and deaf children, it will be seen that we do not support this view. As far as we have been able to determine, no significant retardation as yet has been indicated. This statement is based on the examination of over 1000 cases. Whether retardation will appear as our investigation proceeds and our numbers accumulate remains to be seen.

The present series of tests was devised primarily for the testing of the deaf. The tests actually employed are for the most part familiar, though some of the tests are new. The whole scale can be and was given without the use of any language whatever. In this connection a word of caution, which originated from a teacher of the deaf, might be given for the benefit of teachers of the deaf. *The teacher when using these tests must be on his guard against giving unwittingly by gesture or expression any assistance beyond that provided for in the directions. These directions must be rigidly adhered to.*

The scale is available up to the age of fifteen. It will be found serviceable for the testing of the hearing child as well as of the deaf. As far as possible, the tests should be given to the hearing child also without language, or with a minimum of language, as in the directions for the hearing which follow.

CHAPTER II

THE TEST MATERIAL

WITH the exception of Test IV and the first part of Test VIII all the tests in the present series may be said to be old. With scarcely any exception, however, the mode of administering and method of scoring are new. In these respects the tests previously used have been modified, very considerably in some cases. The primary object of these modifications has been to simplify the giving and scoring of the tests, at the same time shortening the time required for the whole series. As the series stands at present it can be gone through in less than an hour, except perhaps with a very slow subject who is taking the maximum time for every test.

The tests were originally arranged to test deaf mutes. To some extent this fact has modified both the tests selected and the method of administering them. For example, language is not used at all with the deaf. It has been found, however, that the tests are equally serviceable with normal hearing subjects, with whom a minimum of language may be used as indicated in Chapter III. The following is a description of the test material.

Test I.—Block Design Test ✓

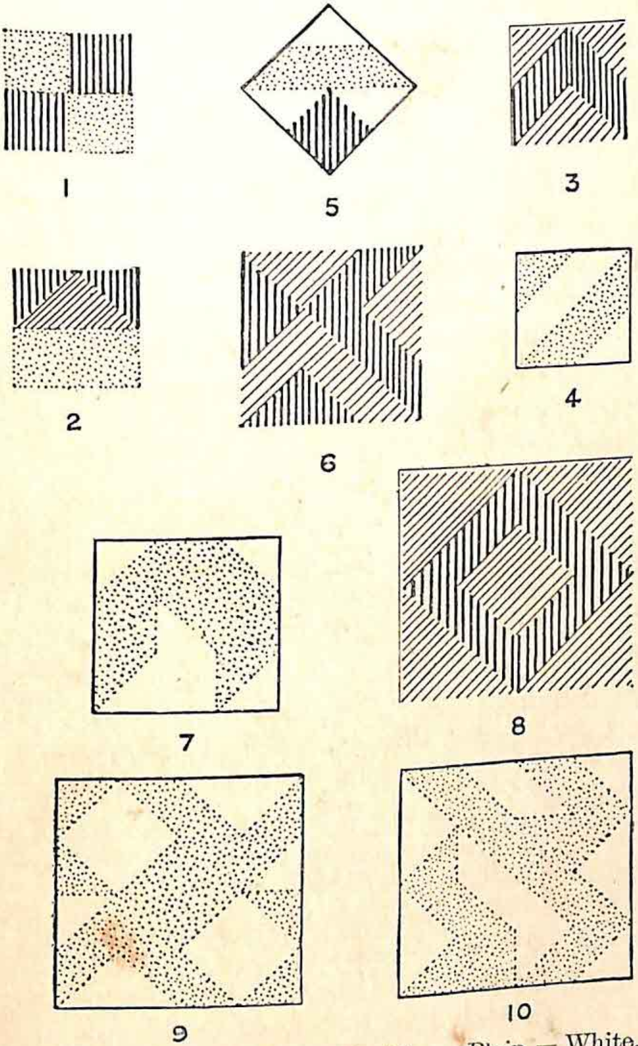
This test is due to Kohs.[1] According to his view it is essentially a test involving mental analysis and synthesis, which are the fundamental characteristics of all intelligence. In testing intelligence by means of the "block design" test, he holds, we are testing analytico-synthetic ability at ever higher levels as the designs increase in difficulty and complexity. Psychologists of the older school might take exception to this view of the matter on the ground that the analytico-synthetic movement of intelligence is definitely characteristic in a strict sense only of the higher conceptual level, whereas in this case the subject is dealing with definite concrete material present before him, and there is no evidence that these higher levels of intelligence are necessary. However that may be, it is certain that processes of mental construction, whether ideational or conceptual, are involved in this test.

---

[1] *Intelligence Measurement.* New York, 1923.

The test material consists of sixteen coloured inch cubes. All the cubes have their faces painted in the same way—white, yellow, blue, red, red and white divided diagonally, and yellow and blue divided diagonally. The colours are such that the cubes can be readily washed, thus obviating the necessity of frequent repainting. In addition to these painted cubes there are ten designs painted in the same colours —red, blue, yellow, white—on cardboard oblongs, 3 inches by 4 inches. The ten coloured designs are selected from the seventeen used by Kohs, and are arranged in order of increasing difficulty. For the construction of the first five designs four cubes only are required—for the construction of the next two nine cubes, and for the construction of the last three sixteen cubes. The ten designs are shown in Fig. 1.

In administering and scoring the tests, Kohs advocates the counting of the moves required in the case of each design as well as the time taken. While this course is probably advisable if the Block Design



Dots = Red. Perpendiculars = Blue. Plain = White.
Obliques = Yellow.

FIG. 1

Test is to be used by itself to obtain an intelligence assessment, it involves the somewhat complicated task of combining two variables to get the score. In the present series the subject passes or fails on each design according as he does it, or fails to do it, within the assigned time limit. In a first try-out of the series, out of 400 subjects—200 normal hearing and 200 deaf—not more than half a dozen scored the possible in this test, and these were all between fourteen and fifteen years old, or upwards. ✓

Test II.—Knox Cube Test

This is the well-known and very useful test devised by Knox. The form in which it is used in the present series is practically that used by Pintner,[1] except for some modifications introduced into the scheme of taps. The test material consists of five inch cubes painted black. Four of these cubes are placed in front of the subject about two inches apart. The fifth is used by the examiner and the subject for tapping. In the test the examiner taps out a pattern of movements or taps with this cube on the four placed cubes, then hands the cube to the subject, and signs for him to repeat the movement or pattern.

Twelve patterns in all are employed, these being arranged in what appears to be the order of increasing difficulty. In the first four each of the placed cubes is tapped once, and the patterns consist therefore of four taps in a certain order. In the second four the patterns consist of five taps, one of the cubes occurring twice, and in the third four of six taps. In every case the pattern starts with the cube towards the subject's *left*. The score is the number of patterns correctly reproduced.

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[1] *A Scale of Performance Tests.*

It is important that the rate of tapping should be kept as nearly as possible constant. The rate of one tap per second has been chosen as a rate which is easy to adhere to and suitable. *The difficulty of the test is altered if there is any significant departure from this rate.*

Test III.—Domino Test

So far as we know this is a new test. It is, like the previous test, a test of memory span, but the conditions are somewhat different. The idea of the test was derived from the memory span for digits test in the Binet-Simon series. As has already been pointed out, the present series was originally employed in the study of the intelligence of deaf-mutes. The memory span for digits test could not be given to deaf-mutes, but it seemed possible to adapt the test for such subjects by presenting visually a series of number forms or figures, and asking the subject to reproduce them. Accordingly the present test was devised. The number forms selected were those employed in the long set of dominoes—double-nine set. Thus the material consists of two sets each of ten square inch

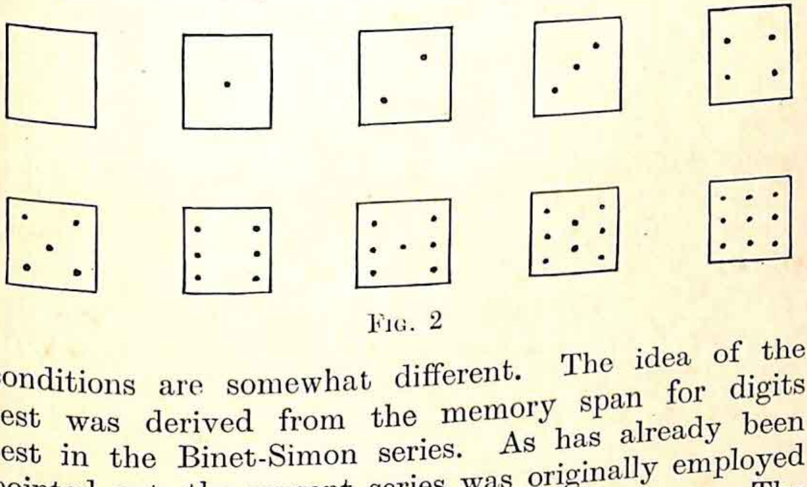

FIG. 2

blocks painted dull black, with white spots arranged to make the different number forms, as shown in Fig. 2.

One possible defect of this test—which was not unforeseen—when employed with normal subjects, and occasionally when employed with deaf-mutes, is that the subject may adopt the plan of naming the numbers to himself. This makes the test very much easier. On the other hand, it must be remembered that this is an intelligent reaction, and on the whole we have come to the conclusion that the test should be allowed to stand, though possibly it places deaf-mute subjects at some disadvantage as compared with normal subjects owing to the greater language facility of the latter. This disadvantage is to some extent reflected in our results, but it is by no means prominent.

Test IV.—Size and Weight Test

This test, as it now stands, was devised and elaborated from the point of view of leading up to the test of arranging in order of weight the seven weights which are used in the second part of the test. The trying-out of the tests being originally done with deaf-mutes, it was essential that the subject should be made to understand clearly what he was expected to do with the weights, and thus understanding had to be brought about without the use of language. To this end the arrangement of cubes in order of size was first introduced, and later it was found that this in itself formed quite a useful test for the younger subjects. Sante de Sanctis had of course already used a test of this kind. It is evident that the comprehension of what requires to be done in this whole test is itself a test of the intelligence of the subject, increasing in difficulty from the first to the second part.

For the first part of the test the material consists of ten wooden cubes. The largest of these is a cube of 6 cm. side, and each successive cube diminishes by 5 mm. to the smallest, which has a side of 1·5 cm. That is to say, the sizes of the cubes are 6 cm., 5·5 cm., 5 cm., 4·5 cm., 4 cm., 3·5 cm., 3 cm., 2·5 cm., 2 cm., and 1·5 cm. Originally the series of cubes used by Sante de Sanctis was employed, which is made up of somewhat larger cubes, and the employment of these cubes would probably make little difference in the test.

For the second part the material consists of five brass weights, as used in shops, of ¼ oz., ½ oz., 1 oz., 2 oz., 4 oz., and even circular wooden blocks, all more or less similar in size and shape to the 1 oz. weight, but weighing respectively 6, 9, 12, 15, 18, 24, and 30 grams.

In the first part of the test, which consists in arranging in order of size the largest five cubes, the other five are used simply for demonstration purposes. In the second part, which consists in arranging in order of weight the seven wooden blocks, the five brass weights are in the same way used merely for demonstration. *The brass weights are not used for hearing subjects.*

Test V.—Manikin and Profile Test

This test is taken with slight modifications from the Pintner-Paterson Scale. The Manikin Test was first used by Pintner,[1] and was by him intended as a test of the same kind as the Profile Test, but for younger children. The material consists of the figure of a man, cut out of wood, and divided into six pieces—the head, the body, the two arms, and the two legs. Outlines of the eyes, nose, mouth, ears, etc., are indicated on the pieces. The legs and arms on the two sides are not interchangeable, the joints being rectangular on one side and circular on the other, in each case.

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[1] Pintner and Paterson, *A Scale of Performance Tests*, p. 53.

The Profile Test was first described by Knox.[1] The material consists of a human head cut out of wood. The face is cut away and divided into three pieces—the mouth piece, the nose piece, and the eye piece. The ear is cut out in the same way, and divided into four pieces. Outlines of the eye, nose, ear, and mouth are indicated on the pieces. In accordance with Pintner and Paterson's procedure, the subject is not told what the figure is intended to represent.

The only modifications of the Pintner-Paterson Test in the present series are :—(1) the assistance given the subject if necessary by putting on the head in the case of the Manikin, and (2) changes in the method of scoring.

Test VI.—Form Boards Test

In the first part of this test Pintner's Two Figure Board is used. The sizes, however, are slightly different, a general diminution of size being introduced in order to make the board more portable. Our board is made in two layers. The under layer is of yellow pine, and measures 30 cm. by 20 cm. by 1·3 cm. The upper edges are bevelled. The upper layer is of oak, also with bevelled upper edges. The two are screwed together from underneath. The upper board measures 28·8 cm. by 18·5 cm. by 0·8 cm. Two figures are cut out of the upper board, one in the form of a cross, the other in the form of a square, with its sides making an angle of 45°

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[1] Knox, H. A., "A Scale, based on the work of Ellis Island, for estimating Mental Defect," *Journ. of the Amer. Med. Assoc.*, vol. lxii., p. 741.

with the edges of the board. The cross measures 13 cm. by 12·5 cm., and the arms are 3 cm. wide. The square has a side of 9·2 cm. The insets are of oiled walnut. To fit into the cross there are four pieces, two of them 6·5 cm. by 3 cm. and 0·8 cm. thick, the other two 4·75 cm. by 3 cm. and the same thickness. To fit into the square there are five pieces, each 0·8 cm. in thickness.

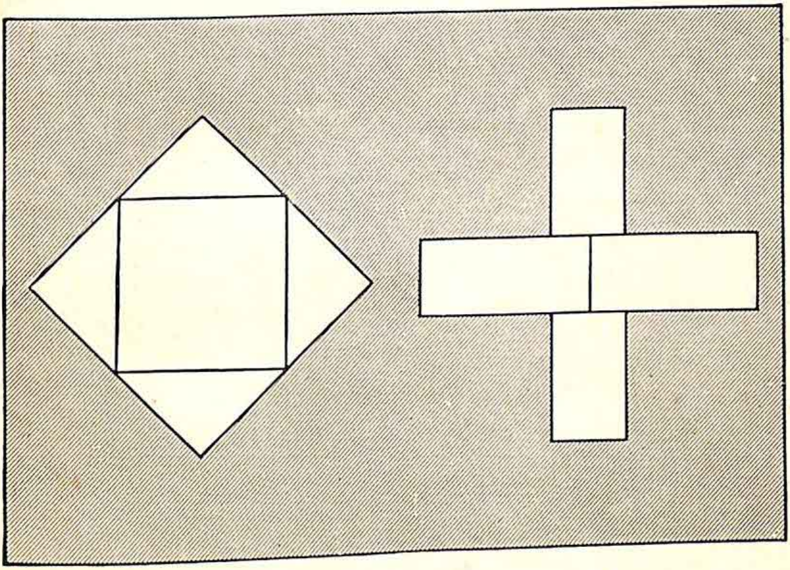

FIG. 3

These are a square of 6·5 cm. side, and four right-angled triangles, each with hypotenuse of 6·5 cm. and equal sides each of 4·6 cm. The board and insets, in their arrangement at the beginning of the test, are shown in Fig. 3.

In the second part of the test, Healy's Puzzle A is used. The board employed differs to a very slight extent as regards dimensions from that which is sold by dealers. It is constructed on the same plan, and with the same materials, as the Two Figure Board just described. A rectangular opening is cut out of the top layer. This opening measures 10 cm. by 7·5 cm. To fit this there are five rectangular pieces measuring respectively, 7·5 cm. by 2·8 cm., 7·2 cm. by 2·5 cm., 5 cm. by 3·4 cm., and two 3·8 cm. by 2·5 cm. each.

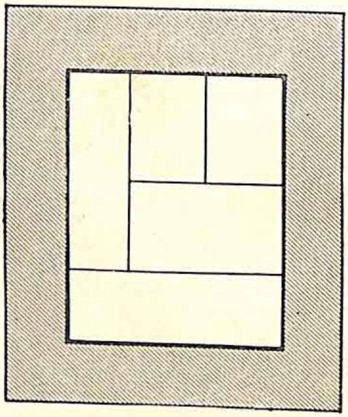

Fig. 4

Test VII.—Cube Construction

This test has been variously named, and given in various ways by different investigators. The method adopted in the present series is practically that employed by Miss Frances Gaw in her investigation for the Industrial Fatigue Research Board.[1] The main alteration made is in the direction of a simplification of the method of scoring the test. As given by Miss Gaw, and in the present series, the test consists of three parts, for each of which different material is used.

---

[1] *Performance Tests for Intelligence.* (Industrial Fatigue Research Board Publications, No. 31, 1925.)

For the first part use is made of what appears to be the middle section of a three-inch cube which has been painted on the outside, and then cut parallel to one of the faces into three sections each an inch in thickness. This middle section is therefore a square prism, one inch in height, with top and bottom unpainted, but painted on the sides. It has to be constructed out of nine inch cubes, four of which are painted on two contiguous faces to form the corners, four on one face only, and one unpainted. The divisions into inch cubes are marked on the large cube section. Red was the colour used by Miss Gaw; in the present series grey is used.

For the second part of the test the top (or bottom) section of the three-inch cube is the model to be constructed. For the construction of this the subject is supplied with nine inch cubes as before, but four of these are painted on three faces meeting at one solid angle, four on two contiguous faces, and one on one face only.

For the third part of the test the model to be constructed is a two-inch cube unpainted. The subject is supplied with eight inch cubes, all of which are painted on three faces meeting at one of the solid angles, and unpainted on the other three faces. To construct the unpainted cube these inch cubes must obviously all be placed with the painted faces inwards.

Test VIII.—Picture Completion

This final test consists of two parts. In the first part the material employed is a picture of "Little Bo-Peep and her Sheep." From this twelve star-shaped sections have been cut, and these sections are placed in haphazard order round the top and sides of the picture, to be inserted by the subject, each in its proper place. So far as we know, this material has not been employed by any other investigator. It has proved very useful for younger children, and it is a very suitable introduction to Healy's Picture No. 1, which is used in the second part of the test. Healy's picture has been standardised both by Healy himself and by Pintner and Anderson.[1] In the present series the method of scoring has been greatly simplified, as compared with that devised by Pintner and Anderson. Otherwise the procedure of these investigators has been followed.

Healy's Picture No. 1 is a highly coloured picture of an outdoor scene. Ten separate events or activities are represented. In connection with each of these a square of one inch is cut out, on which a significant object is represented. The test consists in finding the appropriate square in each case, and inserting it in its place. Fifty squares in all are offered among which the subject must choose. Ten of these are the correct objects, ten are blank, and the other thirty have on them representations of other objects than the right ones. No assistance is given by the background of the picture, which is uniform in colour. The only guidance the subject can rely on is that given by meaning. It is really an intelligence test of the same type as Ebbinghaus's Completion Test. The essential difference is that it is a test without the use of language.

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[1] *Educational Psychology Monographs*, No. 20, Warwick and York, Baltimore.

CHAPTER III

DIRECTIONS FOR GIVING AND SCORING THE TESTS

The passages in italics are for the testing of hearing children.

Test I.—Block Designs ✓

THE tester supplies himself with a stop-watch. The subject (S) is seated opposite the tester at a small table.

Take four of the sixteen blocks and place them before the subject, all the blocks having the *white* side up. Then turn the blocks (or get the subject to turn them), showing in succession the blue, the yellow, the red, the red and white, and the blue and yellow sides. The object of this part of the procedure is, on the one hand, to show the subject the colour or colours on each of the sides, and, on the other hand, to make clear to him that all the blocks are the same. Hence care must be taken to secure that all the blocks show the same side at one time. Say, "*You see they are all the same.*"

(1) Take now Design No. 1, place it before the subject, and show him how to make it up with the four blocks. Scatter the blocks, and turn them *all* over. Sign to the subject to put them together again to form the design. Say, "*You do it.*" If he does not respond or fails to produce the design, show him again slowly and carefully. Scatter, and turn over once more, and sign to put together. Credit the subject with this part of the test, if he succeeds at the first or the second attempt. If he fails, go on to Test II.

Score 2 points for success.

(2) After scattering and turning over the blocks, so that no more than *one* shows the right side up for Design No. 2, place this design before the subject, and sign to him to construct it with the blocks. Say, "*Make this one.*" Allow one and a half minutes. If the subject is not successful within this time, construct the design for him, and go on to Design No. 3, without letting him try a second time.

Score 2 points for success.

(3) After scattering and turning over the blocks as before, so that no more than *one* shows the right side up for Design No. 3, place this before the subject, and sign to him to construct it. Say, "*Make this one.*" Allow two minutes. If he fails to construct it within that time, proceed as with Design No. 2. If he has already failed with Design No. 2, go on to Test II.

Score 2 points for success.

(4) and (5) Proceed with Designs Nos. 4 and 5 as with 2 and 3. Allow two minutes in each case. Go on to Test II if the subject fails in two designs in succession.

Score 2 points for success in each case.

Add now five more blocks, showing the subject the various sides, so that he may realise that they are all the same as those with which he has been working. Say, "*You see these are all the same.*"

(6) Proceed with Design No. 6 as with previous designs, being careful to see that not more than *two* of the blocks have the right side up for this design at the beginning. Allow three minutes. If the subject

fails to construct in that time, show him and go on to Design No. 7, unless he has already failed in Design No. 5, in which case go on to Test II.

Score 3 points for success.

(7) Proceed as with Design No. 6, placing Design No. 7 before the subject. Allow three minutes.

Score 3 points for success.

Add the other seven blocks, showing the subject as before that all the blocks are similar.

(8) Proceed with Design No. 8 as with Design No. 7. Allow three and a half minutes.

Score 4 points for success.

(9) and (10) Proceed with Designs Nos. 9 and 10 as with previous designs. Allow three and a half minutes each.

Score 4 points for success in each case.
Total Score for Test I, 28 points.

Test II.—Knox Cubes

Place four of the cubes about two inches apart in front of the subject. Take the fifth cube in the right hand, and *beginning always with the cube at the left-hand side for the subject*—the cubes being numbered for the experimenter from his left, 4, 3, 2, 1—tap with this fifth cube the cubes 1, 2, 3, 4, in succession, at the rate of one tap per second. Say, "*Watch.*" Hand the fifth cube to the subject, and sign for him to do as you have done, emphasising, by pointing, the fact that he must start with the cube on his left. Say, "*You do it.*" If the subject does not respond, repeat. If he fails to respond on repetition give him a third chance, and if he still fails, go on to Test III. If he succeeds at the first, second, or third chance, tap in the same way 1, 3, 2, 4, and proceed through the series of patterns given below, allowing only one chance for each pattern except the first, until it is clear that the subject is not likely to be successful in any more. In each case say, "*Watch again*" and "*You do it.*" Score the number of successes.

Series of Patterns of Taps

1 2 3 4
1 3 2 4
1 4 3 2
1 4 2 3

1 3 2 4 3
1 4 3 2 4
1 2 4 3 4
1 3 1 2 4

1 4 3 1 2 4
1 3 2 4 1 3
1 4 2 3 4 1
1 3 4 2 1 2

Total Score for Test II, 12 points.

Test III.—Dominoes

Arrange one set of dominoes in front of the subject, and the other in front of the experimenter. (They should be seated at opposite sides of a table.) The dominoes should be arranged about one inch apart in the order, 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, from the left of the subject for both sets. Call the attention of the subject to the number of spots on each domino, beginning with 1 of his set, and taking the dominoes in succession to 0. Do the same with the experimenter's set, making it clear that the two sets are exactly alike. The subject should be asked to tell the number in each case, either verbally or by holding up the same number of fingers.

The test itself should now be begun. Lift from the experimenter's set domino 5, and place it in front of the subject. Count one, two, three, inaudibly in seconds, remove this domino, and sign to the subject to pick out the same domino from his set and place it in front. Say, "*You place out the same one.*" Treat 7 in the same way, and then 9, whether the subject is successful with the preceding dominoes or not.

At this point place a screen in front of the experimenter's set. Arrange two dominoes behind the screen, expose as before for three seconds, and sign to the subject to place out the same two dominoes. Say, "*You place out the same dominoes in the same order.*" If the subject picks out the two dominoes correctly, but places them in the wrong order, draw his attention to the error for the sake of the succeeding trials, by re-exposing the two dominoes to be matched, and getting the subject to correct his placing. When the subject has been successful with two dominoes, proceed in the same way with three, then with four, and so on, according to the scheme below. Three chances are given at each level, but only if necessary. If the subject fails in all three, go on to Test IV. The digits below are arranged as they appear to the subject in each case.

	Scheme.		Score for one success.
5	7	9	1
27	64	83	2
436	735	149	4
5308	2971	4063	8
36194	73280	15768	12
283671	417362	190635	16

Score the points opposite the last line at which the subject succeeds.

Total Score for Test III, 16.

Test IV.—Size and Weight

Part I.—(This part of the test may be omitted, but credited if the subject has scored at least 12 up to this point.)

Take the five smallest cubes, and place them in irregular order in front of the subject. Pick out the largest of the five, placing it towards the left of the subject, then the second largest, placing it next towards the right, and so on until the cubes are arranged in order of diminishing size from left to right. Indicate that this is so to the subject by movements of the hand. Disarrange, and sign to the subject to rearrange in order of diminishing size as before. Say, "*You do that.*" If he does not respond, or responds in such a way as to show he has not grasped the idea, arrange the five cubes for him once more, scatter, and sign for him to rearrange. If, after repetition, he is still unsuccessful, go on to Test V. No score is given for this part of the test, which is intended to serve merely as a demonstration. If the subject has been successful at the first or second attempt, remove these five cubes, and place before him the other five in irregular order, signing to him to arrange them in a series as with the previous five.

> Score 5 points for correct arrangement, 3 if two cubes are interchanged, 0 if more than two are misplaced.

Part II.—Take the five brass weights and place them in irregular order in front of the subject. Arrange them in order of descending weight from left to right (for the subject), making clear that they are being arranged according to weight and not according to size, by balancing two against one another, one in each hand, in the process of arranging. Disarrange them, and sign to the subject to rearrange. If he is not successful, repeat. If he is again unsuccessful, go on to Test V. Omit this part of the test with hearing subjects. If he is successful, take the five weighted discs (or cubes), 6, 12, 18, 24, and 30 grams, place them in irregular order in front of the subject, and demonstrate the arranging of them in order of descending weight from left to right. Tell the subject to lift the discs in turn and feel their weight. Disarrange, and sign to the subject to rearrange. Say, "*Now you arrange them.*" If he is successful, give him the two additional weights 9 and 15 grams to put in their respective places in the series. Say, "*Now place these two weights where they should go.*"

Score 7 if all seven are correctly arranged, 6 if either 9 or 15 is placed wrongly, 5 if series of five is correct but the subject fails to place both the others, and 3 if in the original arrangement 6, 12, and 24 are in correct order, though the others are wrong.

Total Score for Test IV, 12 points.

Test V.—Manikin and Profile

Part I.—Manikin.

Arrange the pieces in front of the subject in the following order:—

Head. Right arm. Right leg. Body. Left leg. Left arm.

Sign to the subject to put together the pieces. Say, "*Put these pieces together.*" If he does not respond, put on the head. If there is still no response, go on to Test VI. Allow two minutes before putting on the head, and another two minutes before recording failure.

Score 4 for a perfect performance. If the head has to be put on score 3. Deduct 1 if arms *or* legs are reversed, 2 if both are reversed, 3 if arms are substituted for legs on either or both sides.

Go on to Part II only if the subject scores 4 or 3.

Part II.—Profile.

Arrange the pieces in front of the subject as shown below :—

	Eye part	
Ear part		Ear part
Nose part	HEAD	Mouth part
Ear part		Ear part

Sign to the subject to put together the pieces, at the same time starting stop-watch. Say, "*Now put these together.*" If the subject has not finished at the end of five minutes, stop him.

Score 10 for perfect performance in three minutes. Deduct 1 for every twenty seconds above three minutes. Score 2 if either face or ear is completed in five minutes.

Total Score for Test V, 14 points.

Test VI.—Form Boards

Part I.—Two-Figure Board.

Place the board in front of the subject with the *cross* towards his right, and the inset pieces arranged beyond the board as shown in Fig. 5.

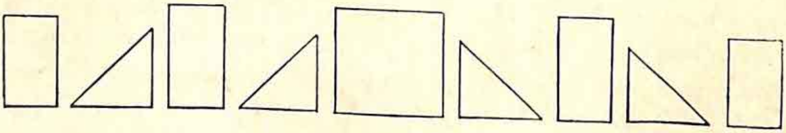

FIG. 5

Sign to the subject to place the insets, and at the same time start the stop-watch. Say, "*Put these piece* *in the spaces.*" Stop the subject at the end of five minutes, if he has not finished.

Score 4 for perfect performance in three minutes. Deduct 1 for every sixty seconds beyond three minutes. Score 1 for completion of either cross or square alone in five minutes.

Part II.—Healy Puzzle A.

Place the board in front of the subject with the shorter side towards him, and arrange the inset pieces beyond it with the two smaller pieces separating the three larger pieces.

Sign to the subject to place the insets, at the same time starting the stop-watch. Say, "*Now put these in.*" Stop him at the end of five minutes if he has not finished.

Score 8 for perfect performance in three minutes. Deduct 1 for every twenty seconds beyond three minutes.

Total Score for Test VI, 12 points.

Test VII.—Cube Construction ✓

Part I.—Cube section, painted on sides, unpainted on top and bottom. Pointing to the corresponding parts of the completed cube section, say, "*It is not painted on the top, nor on the bottom, but it is painted round the sides.*" Say "*Watch,*" before demonstrating putting together the cubes. Call attention to the corner cubes, etc., without using language. Then say, "*You do it.*"

Call the attention of the subject to the painted sides and unpainted top and bottom. Construct the section with the smaller cubes, calling particular attention to corner cubes with two painted sides, and to the central unpainted cube. Mix the cubes, and sign to the subject to reconstruct the section, at the same time starting the stop-watch. Stop the subject at the end of five minutes if he has not finished.

Score 4 for perfect performance, deducting 1 for every cube wrongly placed.

Part II.—Cube section, painted on top and sides, unpainted on bottom. Pointing to the corresponding parts of the completed cube section, say, "*It is painted on the top, and on the sides, but it is not painted on the bottom.*" Giving the subject the cubes, say, "*You make one like it.*"

Call the attention of the subject to the painted top and sides and the unpainted bottom, but do not give any construction demonstration. Place the section with the painted top up, mix the cubes, sign to the subject to construct, and start the stop-watch. Stop the subject at the end of five minutes if he has not finished.

Score 6 for perfect performance, deducting 1 for every cube wrongly placed.

Part III.—Cube of eight sections, unpainted on outside. Pointing to the complete cube, and turning it over, say, "*This one is not painted at all.*" Then, lifting one of the small cubes, say, "*It is painted on three sides, and not painted on three sides.*" Point each time to the corresponding parts. Then say, "*All the others are the same,*" and pointing to the larger cube, say, "*You make one the same as this.*"

Call the attention of the subject to the unpainted outside, and also to the fact that all the small cubes have three sides painted and three sides unpainted, but do not demonstrate construction. Place the model in front of the subject, and sign to him to construct with the small cubes, at the same time starting the stop-watch. Stop the subject at the end of five minutes if he has not finished.

Score 8 for perfect performance, deducting 1 for every cube wrongly placed.

Total Score for Test VII, 18 points.

Test VIII.—Picture Completion

Part I.—Star Picture.

Place the picture in front of the subject with the star pieces arranged in haphazard order along the top and sides. Sign to him to place the pieces in the star-shaped holes, and simultaneously start the stop-watch. Say, pointing to the picture and the pieces, "*Put them all in the right places.*" Stop the subject at the end of three minutes if he has not finished.

Score the number of pieces correctly inserted divided by 2 ($\frac{1}{2}$ counting as 1 except that $5\frac{1}{2}$ points counts only 5). Score 6 for perfect performance.

Part II. Healy's Picture No. 1.

Place the picture in front of the subject, and the box with the inset pieces at the top of the picture. The pieces should be arranged right side up in haphazard order in the box, but no two correct pieces should be found together.

Make the nature of the task to be performed clear by calling the subject's attention to the place where the wheel should be inserted, and to *the driver looking, the man pointing,* and *the end of the axle of the waggon.* Find the wheel and place it in the right space. Sign to the subject to insert pieces in the other spaces, simultaneously starting the stop-watch. Pointing to the empty space where the wheel should go, say, "*What is missing here?*" The subject should answer, "Wheel." Then say, "*Let's find it among these,*" and, after placing it in the space, "*Now put in what is missing in the other spaces.*" Stop him at the end of five minutes if he has not finished. (The child should be assisted in removing any piece if he clearly indicates that he wishes to change it.)

Score as follows:—Broken Window, 2; Whole Window, 1; Football, 2; Baseball, 1; Pumpkin, 1; Correct Cat, 2; Departing Cat, 1; Sleeping Cat, 1; Flying Bird, 2; Sitting Bird, 1; Dog, 2; Basket, 2; Cock, 2; Hat, 2; Log, 2.

Score for perfect performance, 18.

Total Score for Test VIII, 24.

Grand Total Score, 136.

CHAPTER IV

NORMS OF PERFORMANCE

In order to obtain provisional norms[1] the scale of tests as described was given to about 400 subjects varying in age from four and a half to sixteen. Of these subjects about half were deaf-mutes, and the other half normal-hearing children. The deaf-mutes consisted of all the children in the Royal Institution for the Education of the Deaf, Edinburgh, and all the deaf children in Donaldson's Hospital, Edinburgh. These provisional norms revealed no significant difference between the hearing and the deaf child. At no year level were the deaf found to be as much as one year retarded. The results obtained, so far from confirming the general view that the deaf child is about three years retarded as compared with the normal, showed rather that, when the language factor is entirely eliminated from performance tests, it is very doubtful whether the deaf child is retarded at all.

The tests have since been given to over 1500 children, deaf and hearing, in various parts of Scotland and England. The norms which follow are based on this more extensive investigation. Two results have emerged: First, the confirmation of the finding as regards the insignificance of the difference between the hearing and the deaf; second, the revealing of a significant difference between the sexes, this increasing with increasing age. Consequently, the norms now given do not distinguish between the results for the deaf and hearing children. Separate norms, however, are given for the sexes.

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[1] See First Edition.

Norms for Boys

(*Showing medians and quartiles for different ages*)

Age.	Highest Quartile.	Median.	Lowest Quartile.
15-16	117	102	91
14-15	113	99	86
13-14	108	95	79
12-13	102	89	73
11-12	95	81	66
10-11	86	71	58
9-10	76	63	50
8-9	67	52	40
7-8	57	42	30
6-7	48	33	21
5-6	35	20	12

Norms for Girls

(*Showing medians and quartiles for different ages*)

Age.	Highest Quartile.	Median.	Lowest Quartile.
15-16	105	95	79
14-15	99	89	72
13-14	95	83	67
12-13	90	76	62
11-12	84	71	56
10-11	76	64	48
9-10	65	54	40
8-9	54	43	33
7-8	44	36	27
6-7	35	29	20
5-6	27	18	14

These norms are shown graphically in Fig. 6.

Note.—In any age group the middle 50 per cent. fall between the two quartiles. The bottom 25 per cent. fall below the lowest quartile, and the top 25 per cent. above the highest quartile. That is, the "average" child will score between the quartiles, the "dull" and the "bright" below the lowest and above the highest respectively.

A table is appended for the rapid calculation of I.Q. from score and age. (pp. 48-49)

Abbreviated Scale

Where the time for testing is limited an approximate assessment of mental level may be obtained from an abbreviated scale, using only Kohs' Blocks, Cube Construction, and Healy's Picture No. 1.

Norms (Provisional)

Mental Age	7	8	9	10	11	12	13	14	15	16
Boys	12	18	22	28	32	36	40	44	49	53
Girls	12	17	21	24	27	31	34	38	42	47

Total 64

I.Q. TABLES

BOYS

SCORES

Age / *I.Q.*	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135	140
15-16	40	46	52	59	65	71	77	83	90	96	102	108	114	121	127	133	136	...	...
14-15	37	43	49	56	62	68	74	80	87	93	99	105	111	118	124	130	133	136	...
13-14	34	39	45	52	58	64	70	76	83	89	95	101	107	114	120	126	129	132	136
12-13	28	33	39	46	52	58	64	70	77	83	89	95	101	108	114	120	123	126	130
11-12	20	25	31	38	44	50	56	62	69	75	81	87	93	100	106	112	115	118	122
10-11	10	13	21	28	34	40	46	52	59	65	71	77	83	90	96	102	105	108	112
9-10	2	7	13	20	26	32	38	44	51	57	63	69	75	82	88	94	98	102	106
8-9	...	...	3	10	16	22	28	33	40	46	52	58	64	71	77	84	89	93	97
7-8	...	...	...	2	7	13	19	24	31	37	42	49	55	62	68	75	80	84	89
6-7	...	...	...	...	...	5	12	15	22	29	33	40	46	53	59	66	71	75	80
5-6	...	...	...	...	...	...	...	2	9	16	20	27	33	40	46	53	58	62	67

GIRLS

Age	Scores																		
I.Q.	**50**	**55**	**60**	**65**	**70**	**75**	**80**	**85**	**90**	**95**	**100**	**105**	**110**	**115**	**120**	**125**	**130**	**135**	**140**
15-16	35	41	47	53	59	65	71	77	83	89	95	101	107	113	119	125	131	136	...
14-15	29	35	41	47	53	59	65	71	77	83	89	95	101	107	113	119	125	131	136
13-14	23	29	33	41	47	53	59	65	71	77	83	89	95	101	107	113	119	125	131
12-13	16	22	29	34	40	46	52	58	63	70	76	82	88	94	100	106	112	118	124
11-12	11	17	23	29	35	41	47	53	58	65	71	77	83	89	95	101	107	113	119
10-11	8	14	19	25	31	36	42	47	53	58	64	70	75	81	86	92	97	104	110
9-10	...	4	9	15	21	26	32	37	43	48	54	60	65	71	76	82	87	94	100
8-9	...	...	3	8	13	18	23	28	33	38	43	48	53	58	63	68	74	80	86
7-8	...	...	...	6	11	16	20	25	29	32	36	40	43	47	52	57	61	67	73
6-7	...	...	...	...	4	9	13	18	22	25	29	33	36	40	45	50	54	60	67
5-6	...	...	...	...	...	...	3	7	11	14	18	22	23	29	34	39	43	49	56

Collins-Drever Performance Tests of Intelligence

Record Card

School .... Name ....

Date .... Age in Mths. ....

Tester .... Mental Age ....

I.Q. =

Test *Score*

I. Blocks

Design	1	2	3	4	5	6	7	8	9	10
Time										
Score										

....

II. Tapping ....

III. Dominoes ....

IV. Size and Weight

(1)

(2) ....

V. Manikin and Profile

(1) Time................. Score.................

(2) ....

VI. Form-boards

(1) Time................. Score.................

(2) ....

VII. Cubes

(1) Time................. Score.................

(2) ....

(3) ....

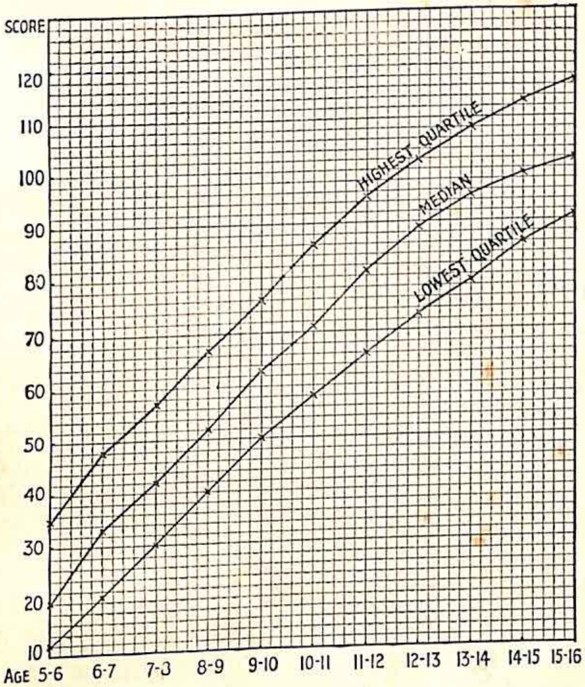
VIII. Picture Completion

(1) Time................. Score.................

(2) ....

Notes : *Total* ....

NORMS FOR BOYS



NORMS FOR GIRLS

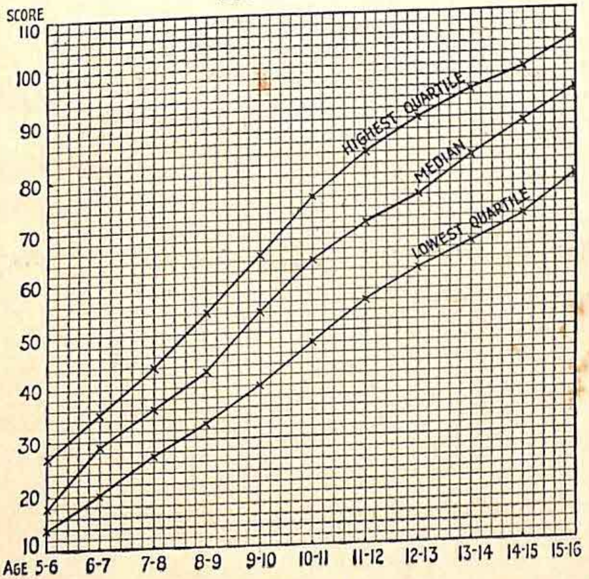


FIG. 6

CHAPTER V

PERFORMANCE TESTS FOR FIVE-YEAR-OLDS

EXPERIENCE with the scale of Performance Tests described in the previous chapters suggests that, although it may be used with children of five or less, it is not at all reliable below six, or even seven. Perhaps "reliable" is not quite the word to employ. The fact is, children of five may score hardly anything at all, even when there is no suspicion that they are feeble-minded, or indeed exceptionally dull. The "Domino Test," the "Profile," both Form Boards, the "Cube Construction Test," and both Picture Completion Tests may yield no points at all. This means that with children as young as this the major part of the scale is entirely out of action. In order to meet this difficulty a supplementary series of tests was arranged for the testing without language of children of six and under.

This series of tests, which we call Series B, consists of six tests, three of which are not contained in the standard series (Series A). The three new tests are the Seguin Form Board, and two simple Picture Completion Tests—the "Mare and Foal" and the "Teacher and Class." The other three are contained in Series A. These are the "Knox Cube Test," the "Size Test," and the "Manikin." As given in Series B, however, these are slightly modified, especially the first, and the scoring is different. Series B then consists of the following six tests in the order given :—

1. Size Test.
2. Knox Cube Test.

3. Seguin Board, and Dearborn Triangle Board.
4. Manikin.
5. Mare and Foal Picture Completion.
6. Teacher and Class Picture Completion.

Size Test.—Except for the scoring this test is that already described on p. 26.

Knox Cube Test.—This also is as already described (p. 24), except that only four cubes are used to begin with in place of five.

Seguin Form Board.—This Form Board is too well known to require description. The arrangement of the insets adopted is that of Pintner and Paterson, not that of Goddard, but this is probably of little or no significance. These insets are always arranged at the start of each trial in a manner to be described later. The subject is given three attempts. He is incited to insert the pieces as quickly as he can, and his score is based on the attempt done in the fastest time.

Dearborn Triangle Board.—This is Dearborn's Form Board No. 4. It consists of a board with twelve depressions, each of which can be exactly filled with the two insets, which are right-angled triangles of the same size and shape. The depressions are numbered from 1 to 12. The score in this test is based on the number of depressions completed in five minutes. Dearborn allows ten minutes, but this time seems needlessly long.

Manikin Test.—This has already been described on pp. 27-28.

"Mare and Foal" Picture Completion Test.—This test, which is one of Healy's, has been found useful for young children by many investigators. Pintner and Paterson advise that the geometrical insets be not used, since, as compared with the other insets, they represent a quite different degree of difficulty. It certainly seems to be the case that they are more difficult than the others, more particularly the divided triangle. But they are not of a different order of difficulty, and there does not appear to be any sufficient reason for not using them.

"Teacher and Class" Picture Completion Test.—This is another of Healy's, and though perhaps a little more difficult than the "Mare and Foal," it is also very suitable for use with young children.

Directions

Test I. *Size Test.*—This is the first part of Test IV in Series A.

Take the five smallest cubes, and place them in irregular order in front of the subject. Pick out the largest of the five, placing it towards the left of the subject, then the second largest, placing it next towards the right, and so on, until the cubes are arranged in order of diminishing size from left to right. Indicate that this is so to the subject by movements of the hand. Disarrange, and sign to the subject to rearrange in order of diminishing size as they were before. If he does not respond, or responds in such a way as to show he has not grasped the idea, arrange the five cubes for him once more, scatter, and sign for him to rearrange. If he fails completely on the second trial, go on to Test II.

Score 5 for perfect arrangement on first or second trial, 3 if two cubes are interchanged, 0 if more than two are misplaced. Remove the five cubes and place before the subject the other five in irregular order, signing to him to arrange them in a series as with the previous five. Do not demonstrate the arrangement this time. Score 10 for perfect performance, 6 if two are interchanged, 0 if more than two are misplaced.

Total Score for Test I, 15 points.

Test II. *Knox Cube Test.*—Place three cubes in front of the subject about two inches apart, thus :—

3 2 1

Take a fourth cube and tap out the following patterns of taps, at the rate of one tap per second :—

1 2 3
1 3 2
2 3 1
3 1 2 (1 is towards the subject's left.)

Sign to the subject to repeat in each case. If he does not respond at the beginning, tap the first pattern a second time, but do not repeat any of the others.

Place now a fourth cube in front of the subject, thus :—

4 3 2 1

Proceed with the fifth cube to tap out the following :—

1 2 3 4
1 3 2 4
1 4 3 2
1 4 2 3
2 4 1 3
3 2 4 1

Sign to the subject to repeat in each case. Score **1** for every pattern correctly reproduced.

Total Score for Test II, 10 points.

Test III. (1) *Seguin Form Board.*—Place the board in front of the subject with the circle towards his left. The subject should be seated in such a position that he can reach and insert all the insets easily. Arrange the insets in four piles, two on each side of the board. In the nearer piles place: on the right—circle, irregular hexagon, cross; on the left—rectangle, semicircle; in the farther piles, on the right—triangle, star, square; on the left—rhombus, oval.

Demonstrate the inserting of the insets. Take them out again, place them in piles as before, and sign to the subject to insert them, starting stop-watch. Incite subject to work as quickly as possible. Give three trials and take the fastest as the basis of the subject's score.

Score 8 for performance under 30 seconds.
,, 7 ,, ,, 40 ,,
,, 6 ,, ,, 50 ,,
,, 5 ,, ,, 60 ,,
,, 4 ,, ,, 70 ,,
,, 3 ,, ,, 80 ,,
,, 2 ,, ,, 90 ,,
,, 1 ,, over 90 and under 120.

(2) *Dearborn Triangle Board.*—Place the board in front of the subject with the two triangles at the top. Demonstrate the filling of the first hole. Replace the triangles at the top, and sign to the subject to place them in the hole. If the subject is not successful within half a minute, show him again. Leave the triangles in the first hole, and sign to the subject to insert them in

the second hole. If he is not successful in half a minute, show him quickly, and then point to hole number 3. If he is again unsuccessful, do not demonstrate, but after half a minute point to the fourth hole. If he again fails, go on to Test IV. If he succeeds, point to the next hole, and so on till he finishes, or until the time has expired. Allow five minutes from the time the subject gets the signal to begin the second hole. Score the number of holes successfully filled.

Total Score for Test III, 20 points.

Test IV. *Manikin Test.*—Arrange the pieces in front of the subject thus:—

Head. Right arm. Right leg. Body. Left leg. Left arm.

Sign to the subject to put together the pieces. If he does not respond, put on the head. If there is still no response, go on to Test V. Allow two minutes before putting on the head, and another two minutes before recording failure.

Score 5 for perfect performance. If head has to be placed on, score 4. Deduct 1 for interchange of arms or legs, 2 if both are interchanged, 3 if either or both legs are placed where the arms should be.

Total Score for Test IV, 5 points.

Test V. *Mare and Foal Test.*—Place the picture before the subject, with the insets, including the two triangles, and the two diamond-shaped pieces, arranged in haphazard order around the top and sides. Sign to the subject to insert insets, simultaneously starting stop-watch. Score the number of pieces inserted by the subject in three minutes. If there is no response in one minute, insert the sheep, and deduct 3 from the number of pieces inserted for the score.

Total Score for Test V, 11 points.

Test VI. *Teacher and Class Test.*—Place the picture before the subject with the insets arranged in haphazard order around the top and sides. Sign to the subject to insert the insets, simultaneously starting the stop-watch. No assistance is to be given with this test. Score the number of insets inserted in three minutes.

Total Score for Test VI, 13 points.
Total Score for series, 74 points.

Norms

The norms which follow are merely tentative and provisional. They are based on too few cases to be altogether reliable.

Age.	Points.	Age.	Points.
4	20	6	45
4½	26	6½	50
5	32	7	58
5½	38		

APPENDIX

COST OF TEST MATERIAL

The test material, as described in Chapters II and V, can be procured from A. H. Baird, Ltd., Scientific Instrument Maker, Lothian Street, Edinburgh. The material can be purchased either in sets or in individual pieces. The following list of present prices has been supplied by the firm mentioned :—

PERFORMANCE TESTS—SET A

No.				
1.	1 set of 16 wood cubes, 1″, coloured, for block design test . . .	£1	0	6
2.	1 set of 17 coloured design cards for above	1	0	6
3.	1 set of 5 wood cubes, 1″, blackened, for Knox cube test . . .	0	3	6
4.	1 double set of 10 dominoes (20 pieces)	1	0	0
5.	1 set of differing round weights . .	0	16	0
6.	1 set of brass weights	0	8	7
7.	1 set of 10 different-sized wood cubes .	0	17	9
8.	1 manikin set	0	18	0
9.	1 feature profile set	0	19	6
10.	1 two figure board set	1	6	6
11.	1 Healy puzzle A set	0	18	6
12.	1 set of three kinds 1″ wooden cubes and blocks painted grey or blue .	0	15	6
13.	1 pictorial completion test Healy 1 .	13	7	6
14.	1 Bo-peep illustration . . .	0	15	6
15.	1 carrying case for above . . .	4	12	6
		£29	0	4

ADDITIONAL MATERIAL FOR SET B

Mare and foal	£3	19	9
Seguin form board	3	14	6
Dearborn's triangle board	3	6	0
Teacher and class	4	10	0
Drever & Collins' book (plus postage) per copy	0	5	0
	£15	15	3

Prices subject to alteration

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